What is claimed is:

[Claim 1]　1. A dielectric material for forming a structure of an integrated circuit, said dielectric material comprising a plurality of carbon nanostructures.

[Claim 2]　2. The dielectric material of claim 1 wherein said carbon nanostructures comprise a plurality of carbon nanotubes.

[Claim 3]　3. The dielectric material of claim 1 wherein said carbon nanostructures comprise a plurality of fluorinated carbon nanotubes.

[Claim 4]　4. The dielectric material of claim 1 wherein said dielectric material has a dielectric constant of less than about 3.

[Claim 5]　5. The dielectric material of claim 1 wherein said structure further comprises at least one conductive feature disposed in said dielectric material.

[Claim 6]　6. The dielectric material of claim 1 wherein said carbon nanostructures comprise a plurality of fluorinated carbon buckyballs.

[Claim 7]　7. The dielectric material of claim 1 further comprising a cap layer on said dielectric material.

[Claim 8]　8. The dielectric material of claim 7 wherein said carbon nanostructures and said cap layer have an effective dielectric constant of less than about 3.

[Claim 9]　9. The dielectric material of claim 1 further comprising:

a copolymer layer binding said carbon nanostructures to define the dielectric material.

[Claim 10] 10. The dielectric material of claim 7 wherein said carbon nanostructures and said copolymer layer have an effective dielectric constant of less than about 3.

[Claim 11] 11. A semiconductor structure formed on a substrate, comprising:

a dielectric layer comprising a plurality of carbon nanostructures; and

at least one conductive feature in said dielectric layer, said conductive feature electrically isolated from nearby conductive features by portions of said dielectric layer.

[Claim 12] 12. The semiconductor structure of claim 11 wherein said dielectric layer has an exposed surface, and further comprising:

a cap layer of an insulating material at least partially covering said exposed surface, said cap layer having a top surface, and said conductive feature having a top surface substantially coplanar with said top surface of said cap layer.

[Claim 13] 13. The semiconductor structure of claim 11 wherein said carbon nanostructures comprise a plurality of carbon nanotubes.

[Claim 14] 14. The semiconductor structure of claim 11 wherein said carbon nanostructures comprise a plurality of fluorinated carbon nanotubes.

[Claim 15] 15. The semiconductor structure of claim 11 wherein said dielectric layer has a dielectric constant of less than about 3.

[Claim 16] 16.   The semiconductor structure of claim 11 wherein said structure comprises a plurality of conductors electrically isolated by said layer of said dielectric material.

[Claim 17] 17.   The semiconductor structure of claim 11 wherein said carbon nanostructures comprise a plurality of fluorinated carbon buckyballs.

[Claim 18] 18.   The semiconductor structure of claim 11 further comprising:

a cap layer disposed on said carbon nanostructures.

[Claim 19] 19.   The semiconductor structure of claim 18 wherein said carbon nanostructures and said cap layer collectively have a dielectric constant of less than about 3.

[Claim 20] 20.   The semiconductor structure of claim 11 further comprising:

a substrate selected from the group consisting of an interconnect level, a dielectric material, a buried barrier layer, a metallization line, and a semiconductor wafer.

[Claim 21] 21.   An integrated circuit comprising a plurality of circuit elements and the semiconductor structure of claim 11, said conductive feature being electrically coupled with at least one of said circuit elements.

[Claim 22] 22.   The dielectric material of claim 11 further comprising:

a copolymer layer binding said carbon nanostructures to define said dielectric layer.

[Claim 23] 23.   The dielectric material of claim 22 wherein said carbon nanostructurse and said copolymer layer have an effective dielectric constant of less than about 3.

[Claim 24] 24.   A method for forming a semiconductor structure on a substrate, comprising:

forming a dielectric layer comprising a plurality of carbon nanostructures on a surface of the substrate.

[Claim 25] 25.   The method of claim 24 wherein forming the dielectric layer comprises:

applying the carbon nanostructures on the substrate by a spin-on coating process.

[Claim 26] 26.   The method of claim 24 wherein forming the dielectric layer further comprises:

converting the carbon nanostructures to an insulating electronic state.

[Claim 27] 27.   The method of claim 26 wherein the carbon nanostructures are converted to the insulating electronic state after the carbon nanostructures are applied.

[Claim 28] 28.   The method of claim 26 wherein the carbon nanostructures are converted to the insulating electronic state before the carbon nanostructures are applied.

[Claim 29] 29.   The method of claim 24 wherein the carbon nanostructures comprise a plurality of carbon nanotubes, and forming the dielectric layer further comprises:

growing the carbon nanotubes on the substrate by a chemical vapor deposition process.

[Claim 30]   30.   The method of claim 29 wherein forming the dielectric layer further comprises:

converting the carbon nanotubes to an insulating electronic state.

[Claim 31]   31.   The method of claim 30 wherein the carbon nanotubes are converted to the insulating electronic state after the carbon nanotubes are grown.

[Claim 32]   32.   The method of claim 29 wherein growing the carbon nanotubes further comprises:

depositing a layer of a catalyst material capable of supporting nanotube growth on the substrate; and
supplying a flow of a carbon-containing reactant gas in contact with the catalyst material layer to the substrate under conditions adequate to grow the carbon nanotubes.

[Claim 33]   33.   The method of claim 29 wherein growing the carbon nanotubes further comprises:

supplying a flow of a gas mixture comprising a carbon-containing reactant gas and a catalyst-containing gas across the substrate under conditions adequate to grow the carbon nanotubes.

[Claim 34]   34.   The method of claim 33 wherein growing the carbon nanotubes further comprises:

forming a plurality of mandrels projecting from the substrate at spaced apart locations across the substrate, each of said mandrels including a vertical

sidewall capable of supporting carbon nanotube growth and an upper horizontal surface incapable of supporting carbon nanotube growth; and

directing the gas flow with a substantially horizontal relationship across a horizontal surface of the substrate, the carbon nanotubes growing laterally from the vertical sidewall across the horizontal surface of the substrate.

[Claim 35] 35.   A method for forming a semiconductor structure for an integrated circuit on a substrate, comprising:

forming a dielectric layer including a plurality of carbon nanostructures on the substrate; and

forming at least one conductive feature in the dielectric layer.

[Claim 36] 36.   The method of claim 35 wherein forming the conductive feature further comprises:

patterning the dielectric layer to form at least one opening; and

filling the opening with a conductive material to define the conductive feature.

[Claim 37] 37.   The method of claim 35 wherein forming the dielectric layer comprises:

applying the carbon nanostructures on the substrate by a spin-on coating process.

[Claim 38] 38.   The method of claim 35 wherein forming the dielectric layer further comprises:

converting the carbon nanostructures to an insulating electronic state.

[Claim 39] 39.   The method of claim 38 wherein the carbon nanostructures are converted to the insulating electronic state after the carbon nanostructures are applied on the substrate.

[Claim 40] 40.   The method of claim 38 wherein the carbon nanostructures are converted to the insulating electronic state before the plurality of carbon nanostructures are applied.

[Claim 41] 41.   The method of claim 38 wherein the carbon nanostructures comprise carbon nanotubes, and forming the dielectric layer further comprises:

    growing the carbon nanotubes on the substrate by a chemical vapor deposition process.

[Claim 42] 42.   The method of claim 41 wherein forming the dielectric layer further comprises:

    converting the carbon nanotubes to an insulating electronic state.

[Claim 43] 43.   The method of claim 41 wherein growing the carbon nanotubes further comprises:

    depositing a layer of a catalyst capable of supporting nanotube growth on the substrate; and
    supplying a flow of a carbon-containing reactant gas in contact with the catalyst layer to the substrate under conditions adequate to grow the of carbon nanotubes.

[Claim 44] 44.   The method of claim 41 wherein growing the carbon nanotubes further comprises:

    supplying a flow of a gas mixture comprising a carbon-containing reactant gas and a catalyst-containing gas across the substrate under conditions adequate to grow the carbon nanotubes.

[Claim 45] 45.   The method of claim 44 wherein growing the carbon nanotubes further comprises:

forming a plurality of mandrels projecting from the substrate at spaced apart locations across the substrate, each of said mandrels including a vertical sidewall capable of supporting carbon nanotube growth and an upper horizontal surface incapable of supporting carbon nanotube growth; and

directing the gas flow with a substantially horizontal relationship across a horizontal surface of the substrate, the carbon nanotubes growing laterally from the vertical sidewall across the horizontal surface of the substrate.